

COLOR EFFECT YARN AND PROCESS FOR THE MANUFACTURE THEREOF

BACKGROUND OF THE INVENTION

[0001] Within the floorcoverings industry there is constant demand for yarns that can be woven, knitted or tufted into backing materials that exhibit novel and aesthetically pleasing appearance. In particular, yarns that, when incorporated into carpets, produce random or irregular color changes over a flooring area are very popular.

[0002] Space-dyed yarns are traditionally made via a process that involves dyeing yarns to create the effect of the color varying at irregular intervals along the length of the yarn, for example by knit-de-knit or warp printing. Such produced space-dyed yarns can produce a variety of visually appealing effects in carpets, including well differentiated color points in an unorganised design. However, the processes are slow and inefficient, adding to the high cost of such products, and the dyeing process itself has environmental drawbacks.

[0003] Another approach to obtaining novel color effects in a yarn is to combine two or more yarns, hereinafter referred to as singles yarns, into a yarn bundle, hereinafter referred to as the product yarn. In the case where at least one singles yarn differs in color or dyeability from the others, product yarns with a wide variety of effects may be manufactured.

[0004] Heather yarns are created by entangling singles yarn individually and collectively, at chosen levels of entanglement, to provide a range of color effects. Heather yarns can, when incorporated into a carpet, produce color effects ranging from well-blended yarns in which a

single color is perceived at normal viewing distance from the floor, to various degrees of speckled appearance, when random points of color can be differentiated by the observer at the normal viewing distance. Yarns that come under this category do not feature the same degree of color differentiation as space dyed yarns.

[0005] In order to produce yarns that can provide similar aesthetics to space dyed yarns, more sophisticated entanglement processes have been developed for the manufacture of yarns referred to as "mock" or "apparent" space dyed. See, for example U. S. Patent No. 5,804,115 (Burton et al), and U.S. Patent No. 6,240,609 and U.S. Patent No. 6,401,315.

[0006] Other approaches to the manufacture of yarns with a similar appearance to space dyed yarns have been made.

[0007] U.S. Patent No. 6,023,926 (Flynn) describes a yarn and process in which two or more singles yarns, where at least one singles yarn differs in color from the others, are false-twisted together at low false twist level to produce a low frequency alteration of the predominant color along the length of the assembly. The false twist is then stabilised by helically wrapping the false-twisted bundle with a very low denier yarn, which itself does not visibly contribute to the appearance of the product yarn.

[0008] U.S. Patent No. 6,536,200 (Schwartz) achieves a similar appearance by separately tensioning two differently colored singles yarns and combining these under controlled varying tension in such a manner

that controllable lengths of the bundle show one color predominantly when the singles yarn of the first color is under low tension and the singles yarn of the second color is under high tension, and vice versa. Again, the bundle is helically wrapped with one or more very low denier yarns, or with monofilament(s).

SUMMARY OF THE INVENTION

[0009] The present invention relates to multicolored effect yarns for use as tufted, woven or knitted face yarns in textile floorcoverings made from a combination of differently colored, dyed or melt pigmented, singles yarns; a process for the manufacture of such multicolored effect yarns, and a floorcovering whose face yarn consists wholly or partially of such multicolored effect yarns.

[0010] A first aspect of the invention relates to a multicolored effect yarn which comprises a core having two or more untwisted bulked continuous fiber (BCF) singles yarns, at least one of which is differently colored than the others, and a single wrapper yarn spirally wrapped around the core, where the wrapper yarn may be differently colored than any of the core singles yarns, or may be the same color as any of the core singles yarns.

[0011] A second aspect of the invention relates to a process for the manufacture of a multicolored effect yarn by bringing together two or more BCF singles yarns, at least one of which is differently colored than the others, in such a manner as to impart substantially zero real, cabled, false or apparent twist thereto, and helically wrapping the thus formed

core of two or more singles yarns with a wrapper yarn, where the wrapper yarn may be differently colored than any of said singles yarns in said core, or may be the same color as any of the singles yarns in the core.

[0012] A third aspect of the invention relates to a carpet comprising, wholly or partially, a plurality of the multicolored effect yarns of the invention tufted, woven or knitted into a backing substrate, and acting as the face of said carpet.

DETAILED DESCRIPTION OF THE INVENTION

[0013] The multicolored effect yarn of the invention consists of two essential components; a core comprising a multiplicity of singles yarns, and a wrapper yarn wrapped around the core in a helical manner.

[0014] The singles yarns utilised in the core are bulked continuous filament (BCF) yarns manufactured in a draw-texturing process in which the texturing is achieved by means of fluid-jet or mechanical crimping.

[0015] In subsequent process steps, the BCF singles yarns are first individually air-jet entangled, interlaced or tacked, at a first degree of entanglement, and secondly the multiplicity of BCF singles yarns forming the core are air-jet entangled at a second, lower, degree of entanglement. Degree of entanglement at the entanglement points along the length of the individual singles yarns, or along the length of the core, may be visually assessed based on the integrity of the entanglement and assigned a value, expressed as a percentage; the higher percentage, the greater the integrity of the entanglement. The degree of entanglement affects the visual appearance of the product yarn.

[0016] Each individual singles yarn is air-jet entangled to a degree between about 75% and about 100%, and the individual singles yarns have between about 40 and about 80 entanglement points per meter. Each individual singles yarn has a denier preferably between about 400 and about 1400. The total denier of the core is preferably between about 1200 and about 4800. Preferably there are between about 2 and about 8 of the BCF singles yarns in the core of the multicolored effect yarn. At least one of the individual BCF singles yarns comprising the core is of a different color to the others, and preferably at least two of the individual BCF singles yarns are of contrasting colors, i.e., exhibit colors from opposing regions of color space.

[0017] The individual air-jet entangled BCF singles yarns are brought together in a further air-jet entangling, interlacing or tacking process, where the multiplicity of the air-jet entangled BCF singles yarns are air-jet entangled together at a degree of entanglement preferably between about 10% and about 25%. The multiplicity of air-jet entangled BCF singles yarns are air-jet entangled together at between about 1 and about 2 entanglement points per meter.

[0018] The core portion of the multicolored effect yarn assembled using the above-described processes is now helically wrapped with a wrapper yarn. The wrapper yarn may be a partially oriented yarn, a flat-drawn yarn or a draw-textured yarn; preferably the wrapper yarn is a partially oriented yarn. In selecting the wrapper yarn for use in the inventive product and process, it is necessary to take into account any

likely dimensional changes of the wrapper yarns, especially shrinkage, which might occur during further processing of the thus-formed multicolored effect yarn, for example in heat-setting, or in use of the multicolored effect yarn in the manufacture of a floorcovering. Minimal, dimensional change is required of the wrapper yarn, and one ordinarily skilled in the art will easily be able to select suitable yarns for this process.

[0019] The wrapper yarn preferably has a denier of between about 150 and 250, and is of a denier less than that of any of the individual BCF singles yarns present in the core of the multicolored effect yarn. The wrapper yarn may be of a different color to any of the BCF singles yarns in the core, or may be the same color as one or more of the BCF singles yarns in the core. Utilisation of a wrapper yarn of the above denier range has been found to allow the assembly of a straight, rather than a twisted or cable-appearance, multicolored effect yarn, and also to allow the wrapper yarn to contribute to the aesthetics of the multicolored effect yarn. Twisting or cabling of the core yarns either prior to or during the process has a deleterious effect on the desired appearance of the product yarn and the subsequent carpet produced therefrom.

[0020] The wrapping process in which the wrapper yarn is helically wound around the core is carried out on a direct cabling device, and example of which is the "CarpetCabler", manufactured by Volkmann GmbH of Germany. In a standard yarn cabling process, two yarns are processed under balanced tensions and the product yarn has a "double

helix" type, cabled or "barber-pole" style configuration. The inventors have found by extensive experimentation, that through the selection of the deniers and types of the core and wrapper yarns and by carefully controlling tensions on the yarns, and further by the degree of helical turns of the wrapper yarn around the core yarn it is possible to produce a stable and balanced product yarn with no residual torque of the desired aesthetic and color appearance in which the core yarn has an essentially straight, untwisted, configuration, with the wrapper yarn helically wound around it.

[0021] The core, which exhibits substantially zero twist, is helically wrapped with the wrapper yarn at a level of between about 40 and about 80 turns per meter. The core and wrapper yarns are preferably tensioned at between 150 and 250 grams during the process. Lower tensions tend to result in twisting of the core yarns. The product yarn may then be wound up into a package, using any standard winding apparatus, and can be utilised directly for incorporation, by tufting, weaving or knitting, into a floorcovering. When tufted with the inventive yarn, carpets are indistinguishable from those incorporating traditional space dyed yarns while having the benefits of superior performance associated with solution-dyed yarns.

[0022] The series of processes described above for the manufacture of the inventive multicolored effect yarns can be carried out as a continuous sequential process, or as a discrete series of steps.

[0023] The core BCF singles yarns and the wrapper yarn of the inventive multicolored effect yarn may be made from the same or different polymer(s). The polymer(s) are selected from fiber-forming polymers, preferably melt-spinnable polymers.

[0024] The melt-spinnable polymers include, but are not limited to, polyamides, polyesters and polyolefins. Non-exclusive examples of the polyamides are nylon 6, nylon 11, nylon 12, nylon 6,6, nylon 6,10, nylon 6,12, and copolymers and blends of same. Non-exclusive examples of the polyesters are poly(ethylene terephthalate), poly(propylene terephthalate), poly(butylene terephthalate), poly(cyclohexane dimethanol terephthalate), poly(ethylene naphthalate), poly(propylene naphthalate), poly(ethylene adipate), poly(ethylene succinate), poly(hydroxybutyrate), poly(lactic acid), and copolymers and blends of same. Non-exclusive examples of the polyolefins are polyethylene, polypropylene, and copolymers and blends of same.

[0025] The core BCF singles yarns and the wrapper yarn of the inventive multicolored effect yarn may be colored in the same manner or may be colored in different manner. The manners of coloration include dyeing of pre-spun fibers or yarns, and producer-coloring of the polymer prior to spinning by incorporation of pigments and/or dyes in the polymer melt. Preferably both the BCF singles yarns and the wrapper yarn are colored by incorporation of pigment(s) into the polymer melt ("solution dyed") prior to spinning. With the suitable selection of pigment(s) familiar to those ordinarily skilled in the art, solution dyed yarns have been found

to offer superior end-use performance over dyed yarns, e.g., low color fade and better resistance to harsh cleaning methods.

[0026] Both the core BCF singles yarns and the wrapper yarn of the inventive multicolored effect yarn may include within the polymer matrix thereof other adjuvants. These adjuvants include, but are not limited to, antioxidants, UV stabilisers, stain-resists, soil-resists, anti-stats, antimicrobials, lubricants, plasticisers, and process aids.

EXAMPLE 1

[0027] Four 600 denier, 30 filaments of trilobal cross-sectional shape, sulfonated nylon 6,6 BCF singles yarns were each individually air-jet entangled with 80 entanglement points per meter, and with a degree of entanglement at the entanglement points of substantially 100%. Each singles BCF yarn had been colored using melt-pigmented to a different shade, the colors being blue, green, red and bronze.

[0028] The four singles yarns were then fed, in parallel fashion with substantially zero real or false twist, into a second air-jet entangling process, where they are air-jet entangled together with 2 entanglement points per meter, and a degree of entanglement at the entanglement points of about 20%.

[0029] The core yarn is then placed in the direct cabling machine as a first feed yarn. A second feed yarn is set up on the machine as the wrapper component; the second feed yarn comprising a 200 denier, 20 filaments of round cross-sectional shape, sulfonated nylon 6 copolymer

partially oriented yarn, which is melt-pigmented to a different color to that of any of the core BCF singles yarns, the color being bright green.

[0030] The yarn tensions of both the core and the wrapper yarns were set to 200 grams and the direct cabling process was carried out to produce the multicolored effect yarn of the invention. The product yarn was then wound up onto a tube. The product yarn denier was 2621.

EXAMPLE 2

[0031] Five solution dyed 600 denier, 30 filaments of trilobal cross-sectional shape, sulfonated nylon 6,6 BCF singles yarns were processed in a similar manner to that described in Example 1 to produce the core yarn. The five colors were red, light green, dark green, blue and bronze. A solution dyed 200 denier, 20 filaments of round cross-sectional shape, sulfonated nylon 6 copolymer partially oriented yarn was used as the wrapper yarn. The core and wrapper yarns were direct cabled in a similar manner to that described in Example 1. The product yarn denier was 3220.

[0032] Both product yarns from Examples 1 and 2 were level-loop tufted to produce carpet that was indistinguishable in appearance to that produced using traditional space-dyed yarns.

[0033] While the invention has been described in conjunction with specific embodiments, it is evident that many alternative modifications and variations will be apparent to those skilled in the art. The preferred embodiments of the invention set forth above are not to be construed as limiting the the invention in any manner. Various changes may be

incorporated without departing from the spirit and scope of the invention as defined in the claims below.